

JAPANESE PLAN FOR SSF UTILIZATION

Toshio Mizuno
National Space Development Agency of Japan

ABSTRACT

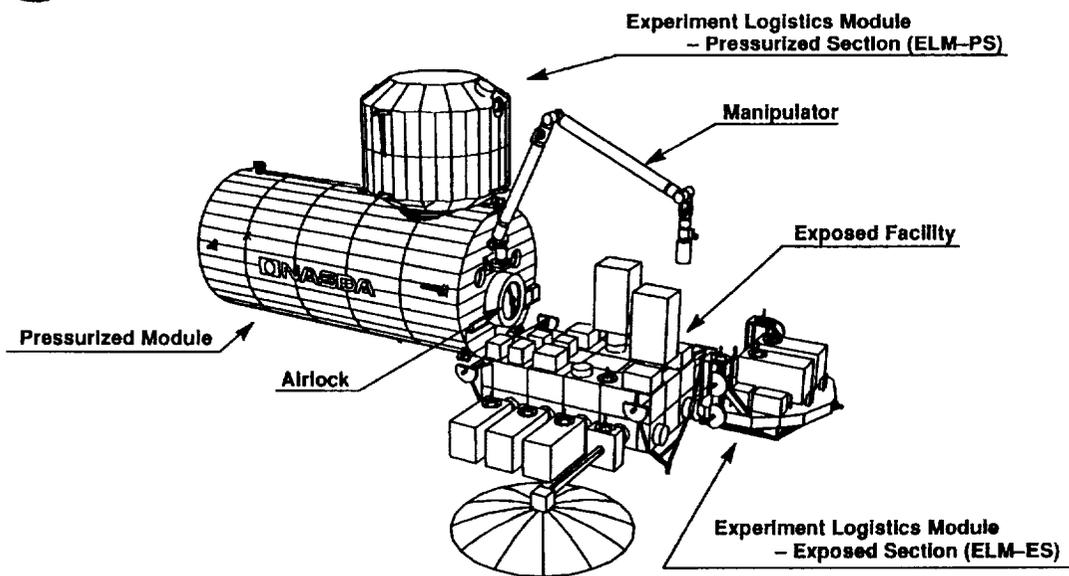
The JEM program has made significant progress. The JEM PDR was completed in July 1992; construction of JEM operation facilities has begun; and the micro-G airplane, drop shaft, and micro-G experiment rocket are all operational. The national policy for JEM utilization was also established. The Space Experiment Laboratory (SEL) opened in June '92 and will function as a user support center. Eight JEM multiuser facilities are in phase B, and scientific requirements are being defined for 17 candidate multiuser facilities. The National Joint Research Program is about to start. Precursor missions and early Space Station utilization activities are being defined.

Japanese Plan for SSF Utilization

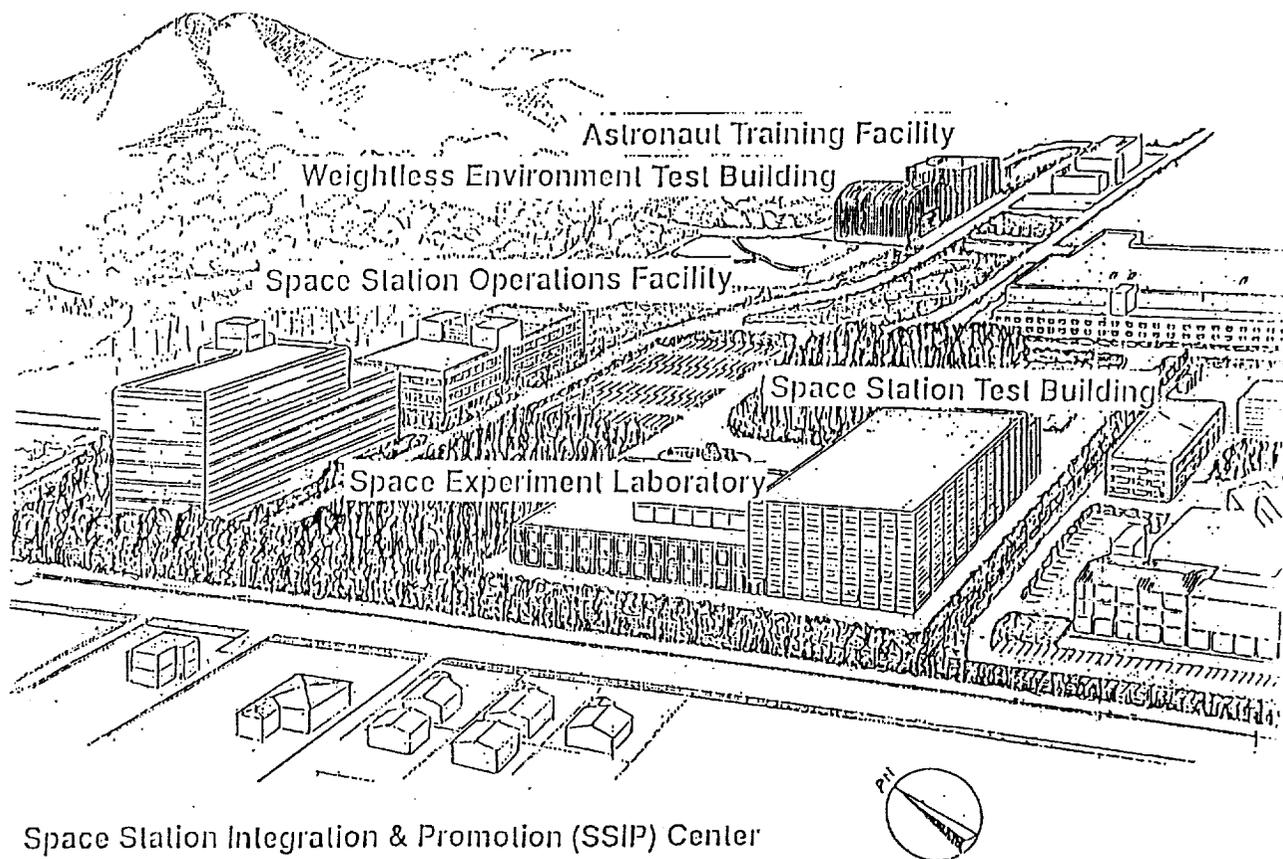
T. Mizuno

August 4, 1992

Huntsville Alabama



JEM Configuration



CONTENTS

1. JEM Program Budget Status
2. JEM Utilization Policy Status
3. JEM Development Status
4. JEM Operations Capability Development Status
5. Status of Ground Research to Develop Generic Experiment Support Technology
6. Status of User Support Center Construction
7. Multuser Facility Development Status
8. Organization National Joint Research Using Space Environments
9. Status of Precursor Mission and JEM Early Utilization Definition
10. Other Topics



1. JEM Program Budget Status (JFY1992)

1.1. JEM Development	¥33.7B(~262M\$)*
(JEM EM, JEM multiuser experiment facility, TR-1A, etc.)	¥24.6B(~190M\$)
1.2. JEM Operations Preparation	¥4.2B(~32M\$)*
(JEM Operations facility, Crew training facility,etc)	¥3.0B(~23M\$)

@1Dollar=129yen

* multiyear government guarantee for appropriation



2. JEM Utilization Policy

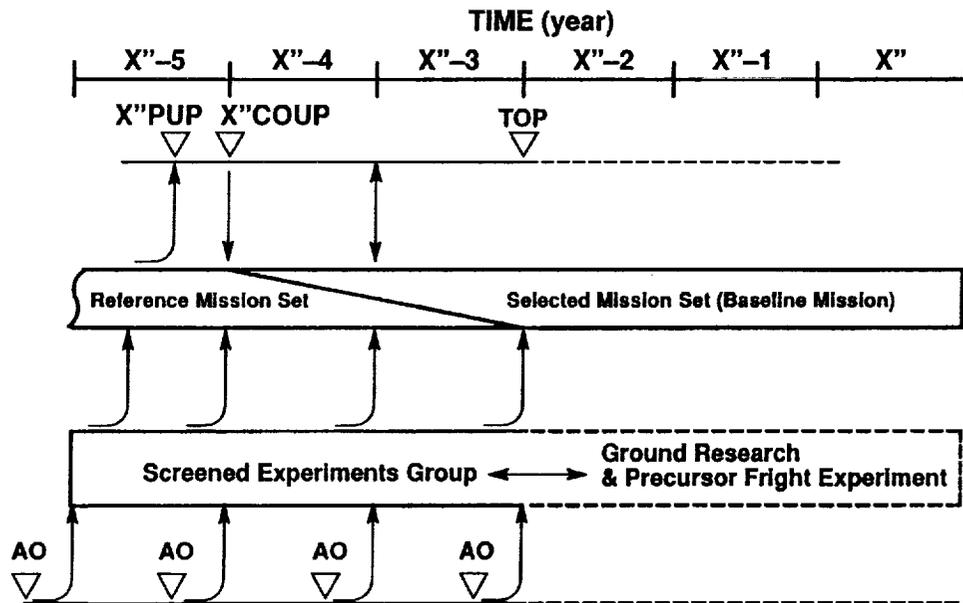
2.1. Report by SAC SS panel was issued in April 1992.

2.2. Report addresses the following:

- (1) Need of national research program for promoting JEM Utilization.
- (2) Importance of developing multiuser facilities
Identification of facility list and development policy.
- (3) Cost sharing by users consistent with JEM and multiuser facility
verification/operation phase.
- (4) Identification of AO issues and experiment selection timing and
frequency.
- (5) Importance of precursor missions.



AO. Experiment Selection, PUP/ COUP/ TOP



3. JEM Development Status

3.1. JEM PDR

Contractor PDR January to March 1992

System PDR June to July 1992

3.2. Technology Development Test

JEM Maintenance and Repair simulation using MSFC WETF in Nov. 1991

3.3. Engineering Model (EM) and Proto-Flight Model (PFM)

EM Contracts started in March 1991

PFM budget request is being prepared

3.4. Construction of JEM Test Facility at TKSC

Construction starts in summer 1992



JEM Development Schedule

J. Fiscal Year	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	
Month	4 8 12	4 8 12	4 8 12	4 8 12	4 8 12	4 8 12	4 8 12	4 8 12	4 8 12	4 8 12	4 8 12	
Milestone			NASA PDR ▽		JEM PDR ▽	NASA MTC CDR ▽	JEM CDR ▽	FEL △			JEM Launch #1 △	JEM Launch #2 △
Activity Phase	Phase B		Phase C/D									
JEM Development		Development Testing			EM Integration and Testing			PFM Integration and Testing				
JEM Operation System		System Design			Detailed Design & Development				Integration & Training		Operation	

PDR Preliminary Design Review
 CDR Critical Design Review (#1, Interface; #2, JEM)
 EM Engineering Model
 PFM Proto Flight Model

NASDA



4. JEM Operations Capability Development Status

4.1. Design of JEM Operations System

PRR March 1991

System Review Oct. 1993

4.2. Crew Recruiting

- MS candidate was selected in April 1992
- SS/SO will be recruited every two years

4.3. Construction of JEM Operations Facility

- Weightless Environment Test Facility construction started in March 1992
- Astronaut Training Facility Construction will start in summer 1993
- Construction of SS Operations Facility (Regional Operation Center for JEM) will start in summer 1993



4.4. Development of JEM Operations Planning system

- Strategic/Tactical planning software and database are being defined

4.5. JFD (JEM Flight Demonstration)

- JEM Manipulator servicing capability demonstration test will be held in 1996 using STS



5. Status of Ground Research to Develop Generic Experiment Support Technology (GEST)

5.1. Drop Shaft/Drop Tube

- JAMIC Facility (10 sec. μ -G) has been operational since 1991
- MGLAB Facility (4.5 sec. μ -G) will be operational in 1993

5.2. GEST Development using μ -G Airplane (MU-300 Business Jet)

- Routine 6 month/year parabolic flight since Sep. 1990

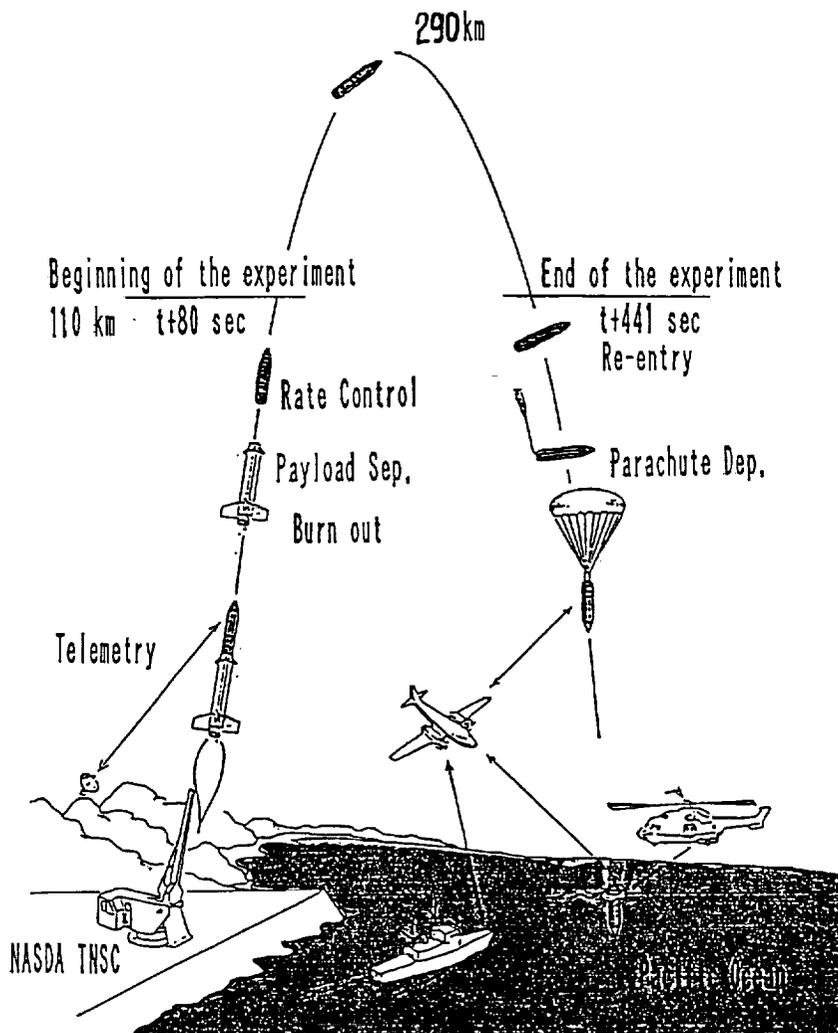
5.3. GEST Development using TR-1A Rocket

- Successful first flight in Sep. 1991
- Next flight in Aug. 1992

Themes and Co-investigators of TR-IA Rocket Microgravity Experiments Program

Experiment Module	TR-IA No.1 September 16, 1991	TR-IA No.2 August-September, 1992	TR-IA No.3 August-September, 1993
Module for Experiment Observation Technologies	Field observation of boundary and environment phase in crystal growth Katsuo Tsukamoto (Tohoku U), Kazuhiko Kuribayashi (ISAS), Tsutomu Sawada (NIRIM)		
Module for Measuring Basic Physical Properties of Fluids (FTX)	Marangoni convection generation and control Hisao Azuma (NAL), Akira Hirata (Waseda U), Keiichi Kuwahara (IHI)		
Module for Experimenting Environment Maintaining Technologies (BDH)	Bubble generation, growth and movement Yoshiyuki Abe (Electrotechnical Lab), Masamichi Ishikawa (MRI), Shinya Ishii (MHI)		
General-purpose Furnace (ITF)	Melting and solidification of particle-dispersed alloy Yuji Muramatsu (NRIM)	(Not applicable)	Ceramic material composition Osamu Odawara (TIT)
Temperature-gradient Furnace (TGF)	(Not applicable)	Semiconductor liquid growth Tatau Nishinaga (Tokyo U)	Effects of microgravity on the shape of solid-liquid boundary Kyoichi Kinoshita (NTT)
High-temperature Furnace (HTF)	Melting and solidification of high-temperature oxide superconductor Kazumasa Togano (NRIM)	Melting and solidification of vitreous material Junji Hayakawa (GIRIO)	(Not applicable)

TR-IA MISSION PROFILE





6. Status of Japanese User Support Center (USC) Construction

6.1. NASDA Space Experiment Laboratory (SEL) at TKSC

- SEL plays an integral role for Japanese USCs
- SEL became operational in June 1992

6.2. Discipline USCs Concept

- Major National Institutes are expected to function as discipline-oriented User Support Center

E.G. NAL for Fluid physics

NIRIM for Inorganic Materials

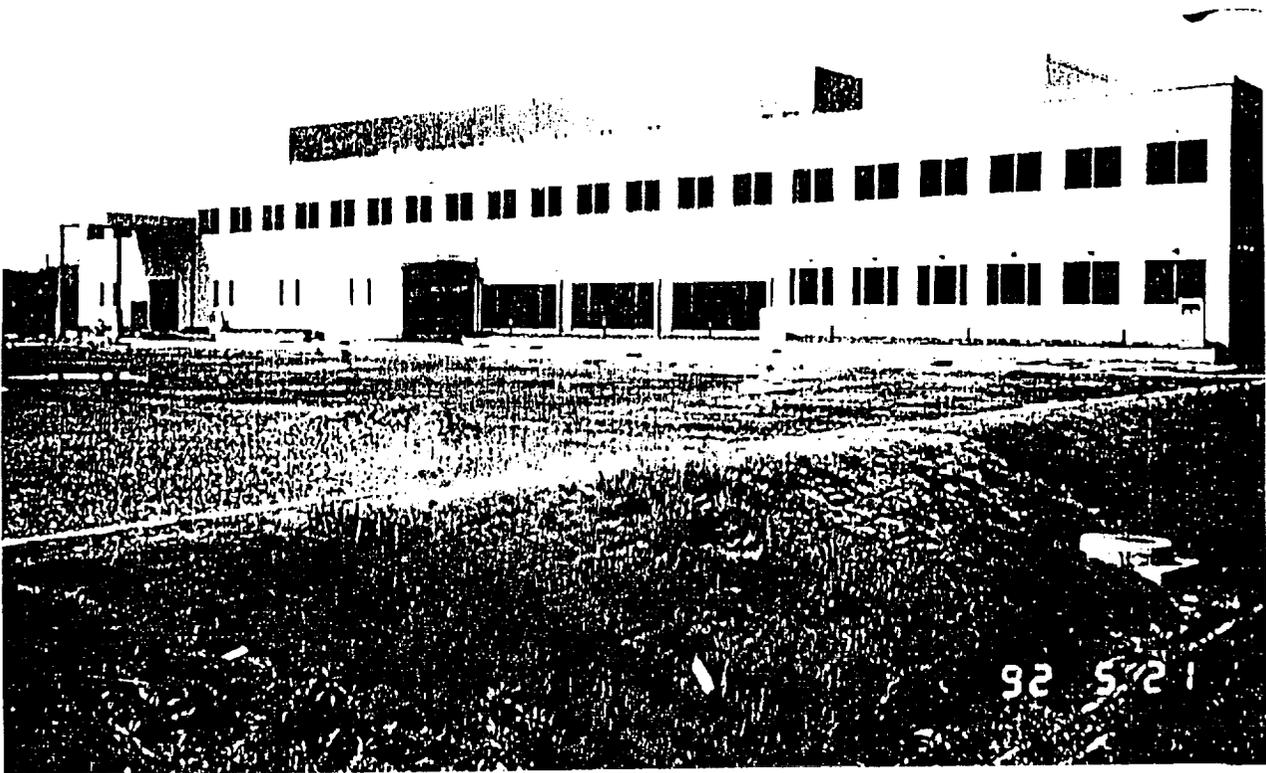
NRIM for Metals

ISAS for Astronomical Observations



6.3. Telescience Technology Application

- Telescience technology will be applied to link NASDA SEL and Discipline Centers



7. Onboard Multi-User Facility (MUF) Development Status

7.1. Selection of MUF

- **MUF Candidate List was completed by Pre-AO survey
List includes three categories, a definitive one, one which needs to be coordinated among international partners, and one which needs to reflect each year's AO**
- **JEM EM system/MUF verification test**
- **JEM traffic model study identifies early stage of MUF**



7.2. Technology Development Status

- 5 MUF technology development will continue until early 1993

7.3. Requirements Update by User Advisory G

- 9 Advisory groups were established
- Requirement update will be completed by summer 1992

7.4. Coordination among International Partner

- Multilateral (MUWG)
- Bilateral



8. Organized National Joint Research using Space Environments

8.1. Significance of the Joint Research

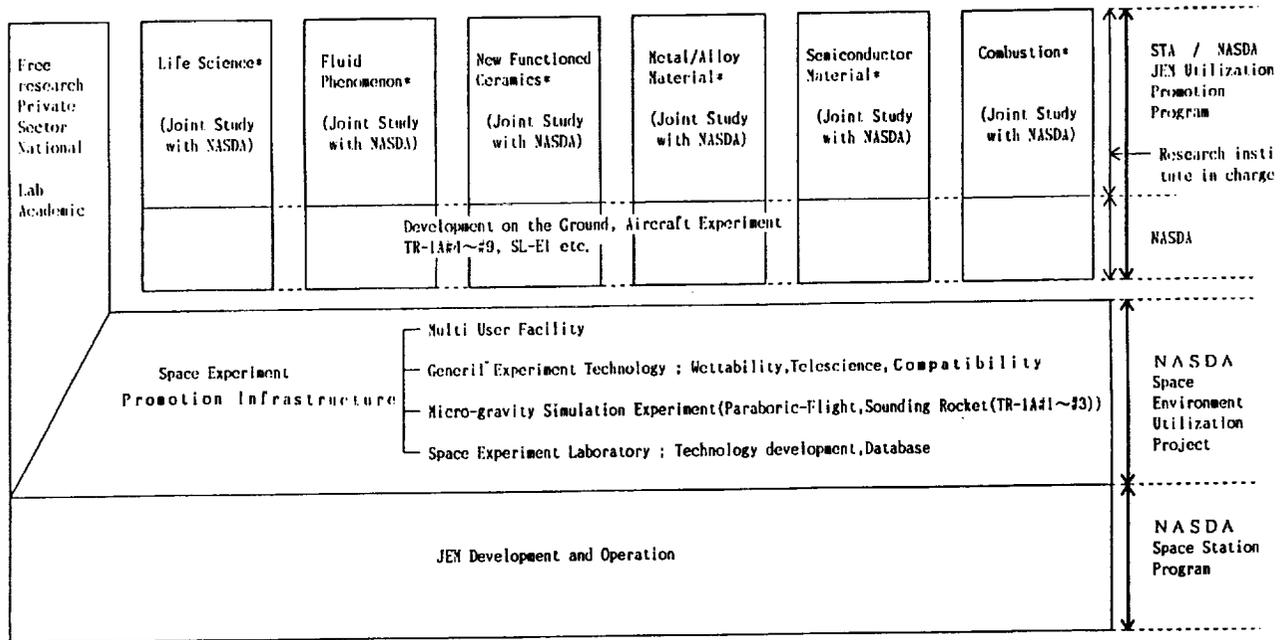
- Enhance research by coordinating/complementing research among national institutes, universities, private sectors
- Easy to accommodate experiments in SS

8.2. Joint Research Plan

- STA authorizes the Joint Research (Core Research)
- NASDA develops experiment technology and offers space flight chance
- Assigned Institute for Core Research conducts the research management
E.G. NAL, NIRIM, NRIIM
- JSUP supports general management of the Joint Research
- The plan will be implemented in mid 1992 and will evolve step-by-step



JEM Utilization Preparation



*: Research Core Name



9. Status of Precursor Mission and JEM Early Utilization of Definition

9.1. Space Experiment Status

- (1) TR-1A sounding rocket
#1 Sep. 1991, #2 Aug. 1992, #3 Summer 1993
follow-on flights are under study
- (2) IML-1
Jan. 22, 1992, 2 NASDA Experiments
- (3) FUWATT '92 (SL-J/FMPT)
Sep. 1992, 34 Japanese Experiments
- (4) SFU Feb.-June 1994
- (5) IML-2 July 1994, 12 Japanese Experiments



9.2. Definition of follow-on Precursor Mission

- (1) Preliminary study of Follow-on TR-1A flight, E1 participation, Spacehab Utilization
- (2) Dialogue with international partners for potential cooperation

9.3. Definition of Early Utilization of the Space Station

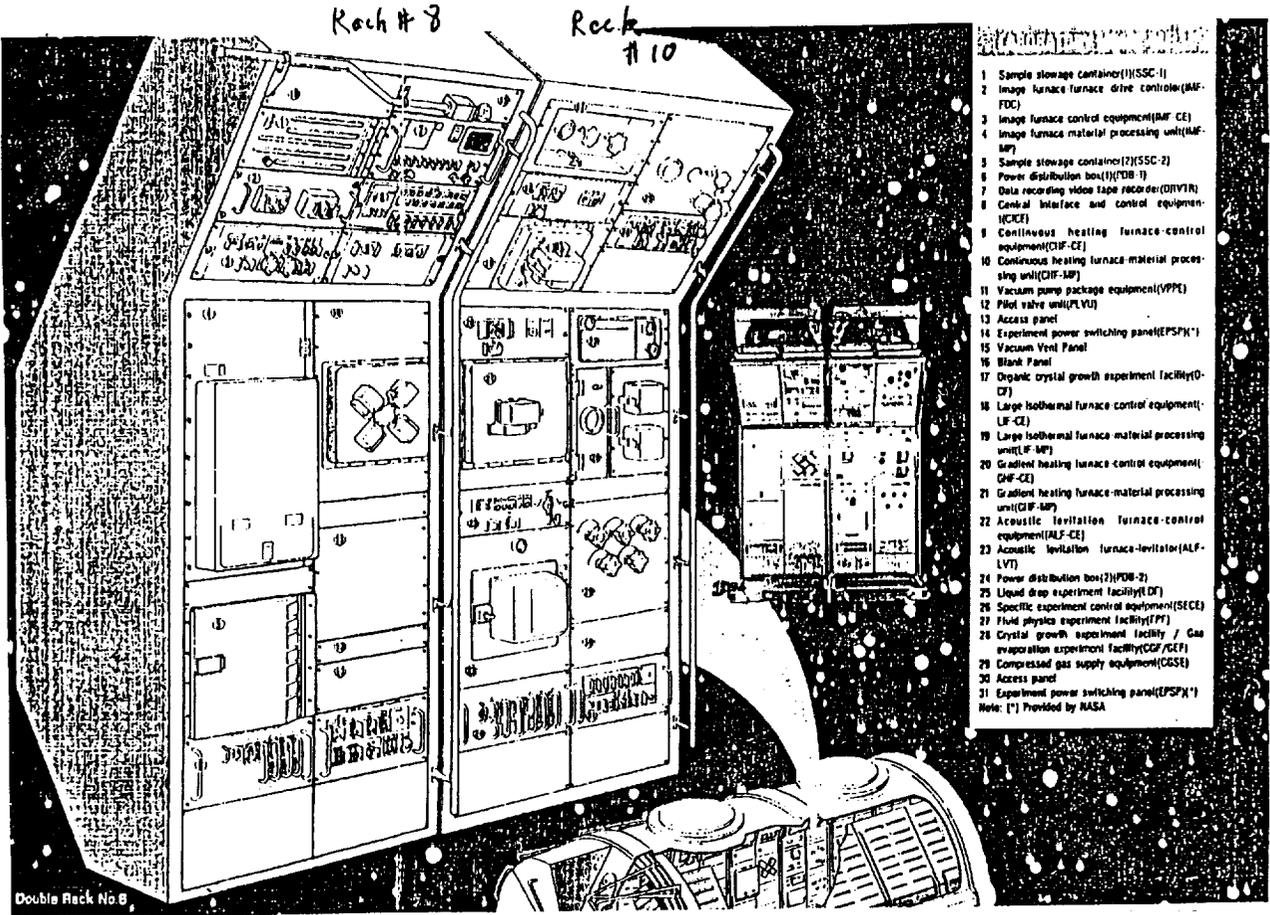
- (1) Traffic model study of JEM early utilization
- (2) Dialogue with international partners for potential cooperation



JEM Utilization Preparation Schedule

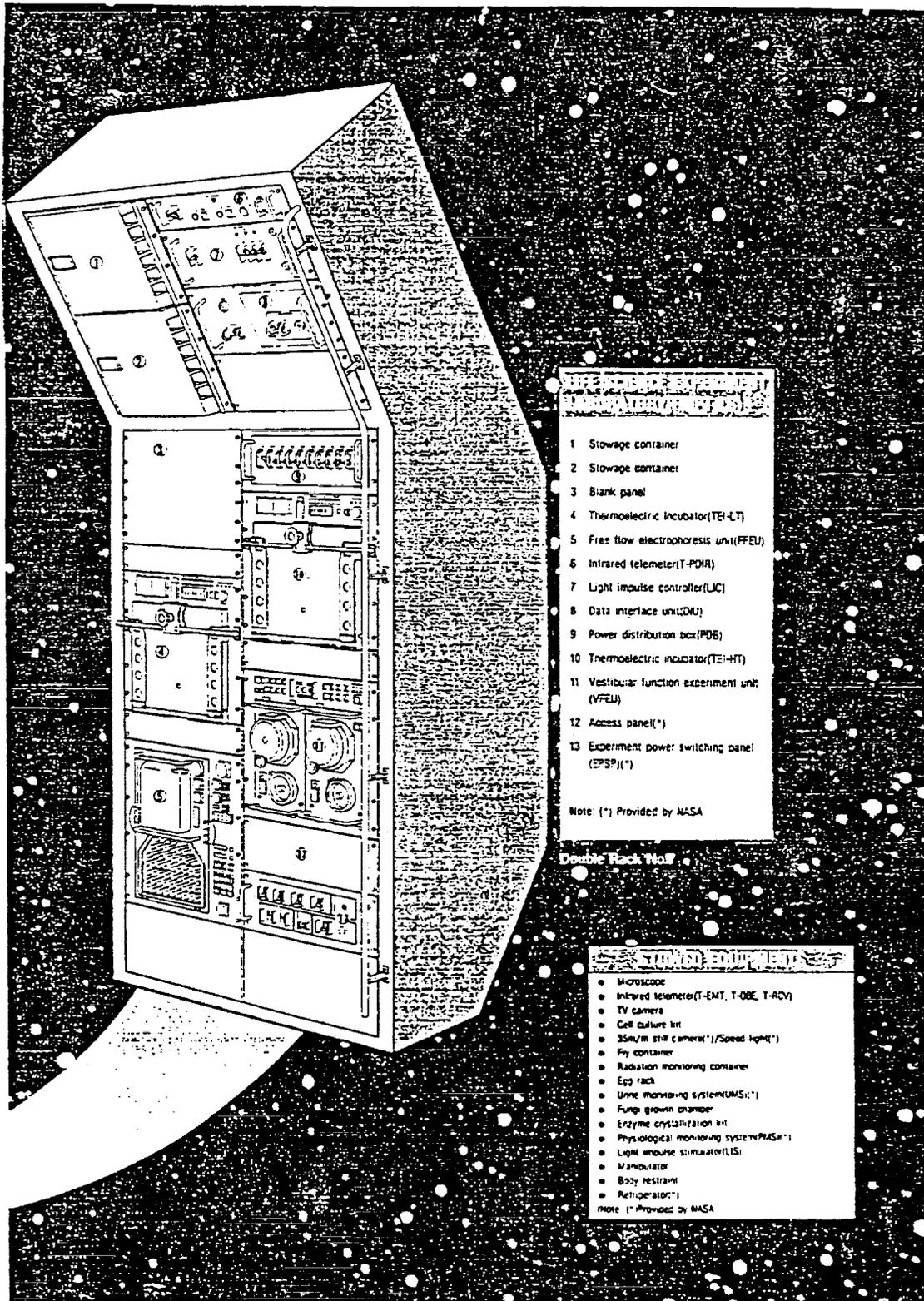
▼ Defined
▽ Planning

J FY	S63/88	H1/89	H2/90	H3/91	H4/92	H5/93	H6/94	H7/95	H8/96	H9/97	H10/98
Space Station					▼ '98 AD	▼ '98 COUP			TOP		▼ JEM #1 ▼ JEM #2
STS / SL Free Flyer				▼ INL-1 92/1	▼ FNPT 92/9		▼ INL-2 94/7 ▼ SFU 94/2-6				
User Support	Work shop ▼ #8 ▼ #9	▼ #10 ▼ #11	Prolo ▼ #12	▼ #13 ▼ #14	▼ #15	▼	▼	▼	▼	▼	▼
Airplane MU-300	Development ▼		Development ▼▼▼ 90/7~	▼▼▼	▼▼▼	▼▼▼	▼▼▼	▼▼▼	▼▼▼	▼▼▼	
Sounding Rocket TR-1A		Development		▼ #1 91/8	▼ #2 92/8	▼ #3 93/8	▼	▼	▼	▼	
Data Base			Development				Operation				
Multiluser Facility				Phase 6		EN		PFR			
Space Experiment Lab.		Development						Operation			



- 1 Sample storage container(1)(SSC-1)
 - 2 Image furnace furnace drive controls(IMF-FDC)
 - 3 Image furnace control equipment(IMF-CE)
 - 4 Image furnace material processing unit(IMF-MP)
 - 5 Sample storage container(2)(SSC-2)
 - 6 Power distribution box(1)(PDB-1)
 - 7 Data recording video tape recorder(DIVTR)
 - 8 Control interface and control equipment(CICE)
 - 9 Continuous heating furnace control equipment(CHF-CE)
 - 10 Continuous heating furnace material processing unit(CHF-MP)
 - 11 Vacuum pump package equipment(VPPE)
 - 12 Pilot valve unit(PLVU)
 - 13 Access panel
 - 14 Experiment power switching panel(EPSF(*)
 - 15 Vacuum Vent Panel
 - 16 Blank Panel
 - 17 Organic crystal growth experiment facility(OCGF)
 - 18 Large isothermal furnace control equipment(LIF-CE)
 - 19 Large isothermal furnace material processing unit(LIF-MP)
 - 20 Gradient heating furnace control equipment(GHF-CE)
 - 21 Gradient heating furnace material processing unit(GHF-MP)
 - 22 Acoustic levitation furnace control equipment(ALF-CE)
 - 23 Acoustic levitation furnace levitator(ALF-LVT)
 - 24 Power distribution box(2)(PDB-2)
 - 25 Liquid drop experiment facility(LDF)
 - 26 Specific experiment control equipment(SECE)
 - 27 Fluid physics experiment facility(FPF)
 - 28 Crystal growth experiment facility / Gas evaporation experiment facility(CGF/GEF)
 - 29 Compressed gas supply equipment(CGSE)
 - 30 Access panel
 - 31 Experiment power switching panel(EPSF(*)
- Note: (*) Provided by NASA

Double Rack No 8



DOUBLE RACK WALL EQUIPMENT

- 1 Storage container
- 2 Storage container
- 3 Blank panel
- 4 Thermoelectric incubator(TEI-LT)
- 5 Free flow electrophoresis unit(FFEU)
- 6 Infrared telemeter(T-POIR)
- 7 Light mouse controller(LJC)
- 8 Data interface unit(DIU)
- 9 Power distribution box(PDB)
- 10 Thermoelectric incubator(TEI-HT)
- 11 Vestibular function experiment unit (VFEU)
- 12 Access panel(*)
- 13 Experiment power switching panel (EPSP)(*)

Note: (*) Provided by NASA

Double Rack Wall

STOWED EQUIPMENTS

- Microscope
- Infrared telemeter(T-EMT, T-OBE, T-ROV)
- TV camera
- Cell culture kit
- 35mm still camera(*)/Speed light(*)
- Fry container
- Radiation monitoring container
- Egg rack
- Urine monitoring system(UMS)(*)
- Fungus grown chamber
- Enzyme crystallization kit
- Physiological monitoring system(PMS)(*)
- Light mouse stimulator(LIS)
- Manipulator
- Body restraint
- Refrigerator(*)

Note: (*) Provided by NASA

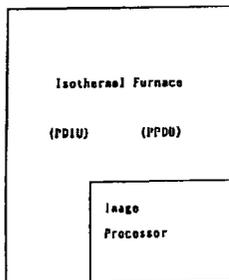
JEM Early Utilization Traffic Model(as is June. 1992)

	1998			1999		
	MB12(JEM#1)	UF5	UF6	MB15(JEM#2)	UF7	UF8
Experiment Equip.	IF ↑ GHF ↑ ZMF ↑ PCF ↑	Clean bench ↑ CCF ↑	FPEF (norm. Temp) ↑ PSAS ↑	ISCS ↑ SEMS ↑	SGF ↑ LF ↑	EPF ↑ SAHF ↑ TES ↑ SPSS ↑ FPEE ↑ (High Temp) VGF ↑
LSE	Image processor			Refrigerator ↑ Freezer ↑		SCF ↑
UP mass (Except Specimen)	~2.5DRE	~0.75DRE	~0.5DRE	~1DRE ~2EEU	~0.75DRE	~0.625DRE ~3EEU

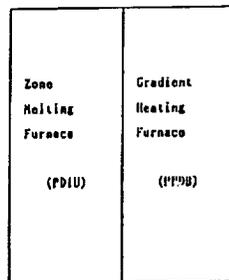
IF : Isothermal Furnace
 SGF : Solution Growth Facility
 PCEF: Physics and Chemistry Experiment Facility
 CCF : Cell Culture Facility
 GHF : Gradient Heating Furnace
 ISCS : Intersatellite Communication System
 TES : Teleoperation Experiment System
 EOT : Earth Observation TEST
 SAHF: Small Animal Holding Facility
 ZMF : Zone Melting Furnace

PCF : Protein Crystallization Facility
 FPEF: Fluid Physics Experiment Facility
 LF : Levitation Furnace
 PSAS: Physiological Signal Acquisition System
 SEMS: Space Environment Measurement System
 SPSS: Small Payload Support System
 SCF : Separation Centrifuge Facility
 EPF : Electrophoresis Facility
 VGF : Vapor Growth Facility

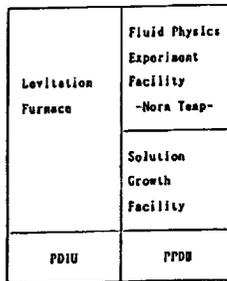
JEM PM Experiment Rack Installation Model



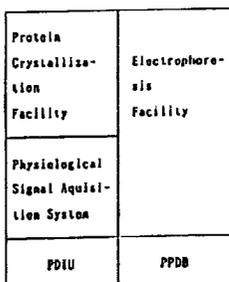
Ground Installation Type
Experiment Rack



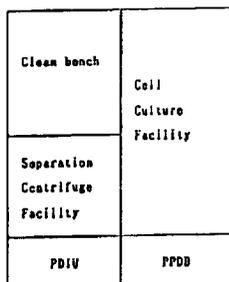
Ground Installation Type
Experiment Rack



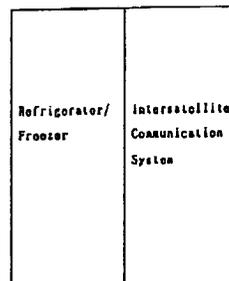
Drawer Type Experiment Rack



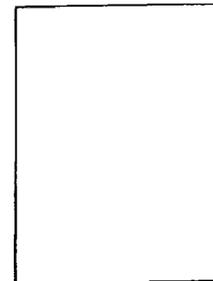
Drawer Type Experiment Rack



Drawer Type Experiment Rack

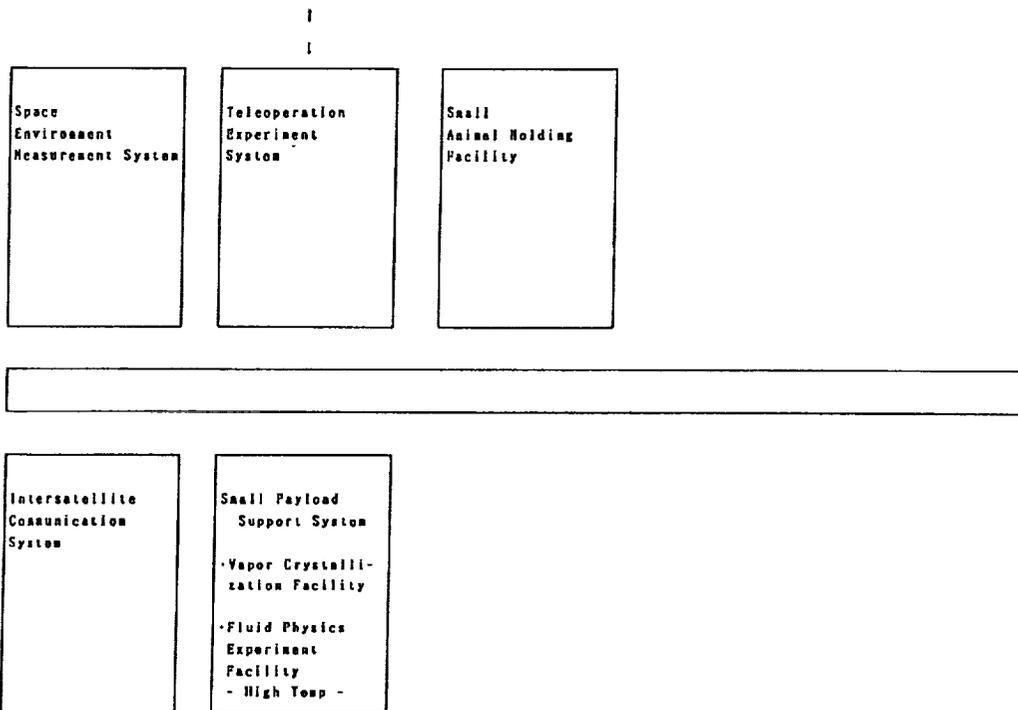


User Storage Rack
(PM ceiling)



User Storage Rack
(ELS-PS)

Earth Observation Test



10. Other Topics

(1) Space Experiment Data Base Development Status

- Data Base in Japanese became operational in June 1992
- Data Base in English will be operational in mid 1993

(2) Telescience Test Bed

- Telescience Test Bed was installed in NASDA SEL in June 1992
- Telescience Demonstration Test for JEM MTC operation will be in Nov. 1992